Reducing carbon emissions from residential heritage buildings while retaining their heritage values

Other

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The Problem: We must urgently reduce carbon emissions to help mitigate the effects of climate change. The building sector accounts for over a third of UK emissions each year, the majority from existing buildings. Up to 20% of UK buildings are heritage buildings. They shape the character of our urban and rural areas but because of their historic values and traditional construction techniques they are particularly challenging buildings for carbon reduction.

Research Aims: I'm exploring ways to reduce carbon and retain history, investigating three poorly understood but key areas:

1. Residents opinions of the heritage values of their buildings and what changes they would find acceptable
2. The energy behaviours of residents
3. The carbon savings of different options and the carbon cost (embodied carbon) to manufacture, transport and install them

I'm focussing on Cumbria and the Lake District National Park which have a high proportion of heritage buildings.

An example of a Cumbrian Heritage Building

Because the best local 'Westmorland green' or 'Borrowdale flags' slate were saved for export Cumbrian roofs used progressively smaller slates towards the ridge. This household has re-slated part of their roof with homogeneously sized dark slates from Brazil or China.

There is a robust debate around whether visible renewables like solar and wind should be permitted in protected areas like National Parks

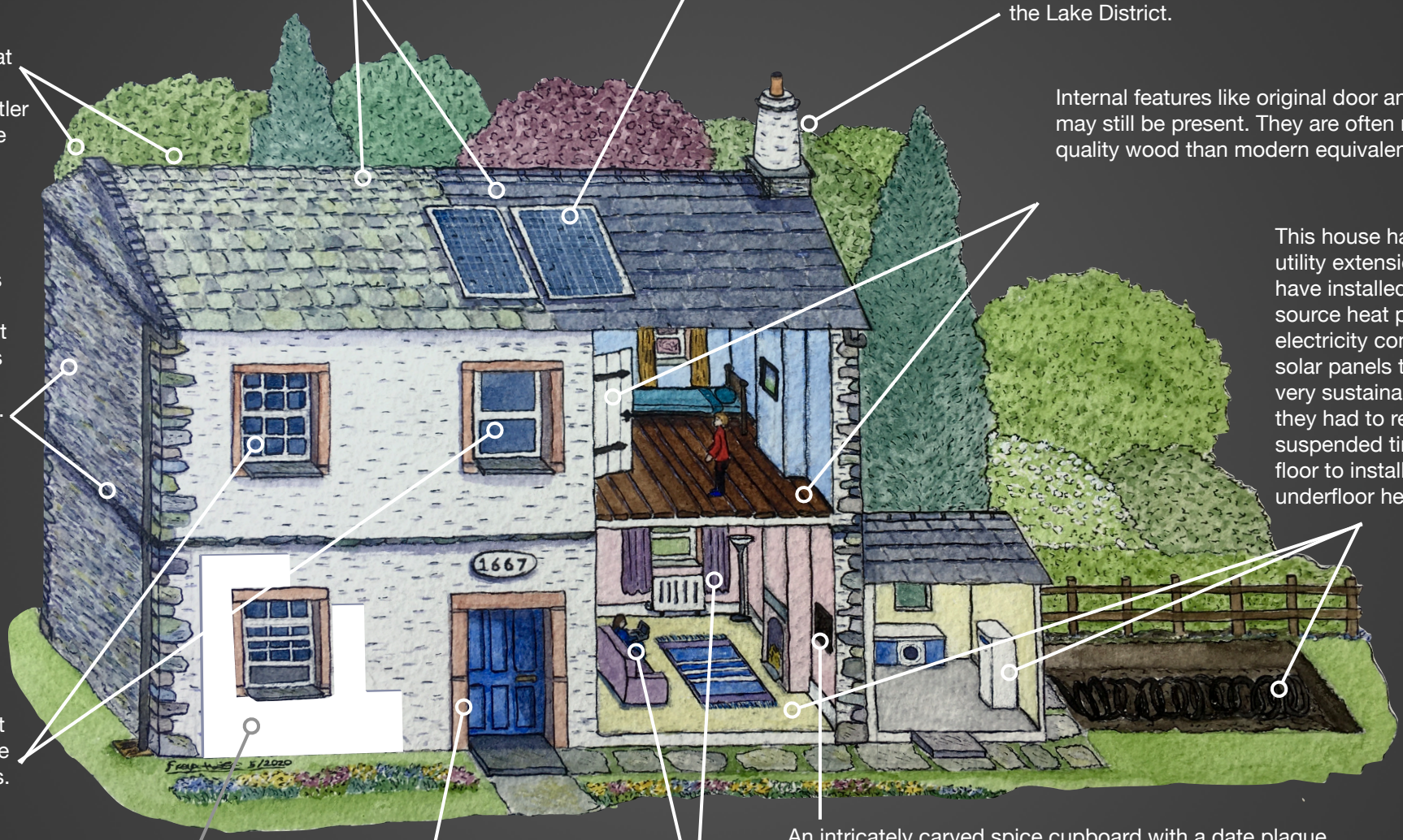
Round chimneys are a distinctive feature in the Lake District.

Flat 'crow steps' at the gables and interlocking 'wrostler slates' at the ridge are traditional features

Internal features like original door and floorboards may still be present. They are often much higher quality wood than modern equivalents.

This house has a small utility extension and they have installed a ground source heat pump, if the electricity comes from the solar panels this could be very sustainable. However they had to replace the suspended timber ground floor to install the underfloor heating

Cumbrian buildings were often lime washed on the front elevation but left as bare stone on the less exposed sides. A layer of 'through stones' gives the walls added strength



Window replacement is a contentious issue for heritage buildings. This household has replaced some of their single glazed timber sashes with double glazed UVPC.

External insulation is a carbon saving option for solid walled buildings but has clear heritage implications for original stonework.

In traditional slate buildings sandstone was often imported for door and window surrounds as it was easier to carve

An intricately carved spice cupboard with a date plaque beside the fireplace is another traditional feature.

Residents' energy behaviours can be a significant opportunity for carbon savings. efficient management of heating, effective use of thick curtains and increased personal insulation (ie slippers!) can have a substantial impact.

Image from original painting by Freya Wise

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Methods:

- Online survey of Cumbrian heritage building residents
- Case studies involving; interviews, building walkthroughs and energy diaries.
- Energy modelling of case study buildings and lifecycle analysis to explore the carbon costs and savings of different options.

Results so far:

1. Residents value the traditional construction, local materials and character of their heritage buildings in the landscape. They dislike changes effecting the building's exterior but are more positive on renewable energy technologies such as solar panels.
2. Most heritage building residents engage in positive energy behaviours such as wearing slippers, putting on more layers rather than turning up the heating and only heating actively used areas of their houses.
3. Embodied carbon must be considered and can effect whether an option actually saves carbon or not, UVPC window replacements are particularly dubious for both carbon savings and heritage values.

Implications: This research will help identify appropriate ways to reduce carbon while retaining history and will inform policy.